

Appendix A

WORK PROCESS SCHEDULE
Fire/Life Safety & Electronic Security Technician
O*NET-SOC CODE: 47-2111.00
RAIS CODE: 0459

This schedule is attached to and a part of these Standards for the above identified occupation.

1. TERM OF APPRENTICESHIP

The term of the occupation shall be four (4) years with an OJL attainment of 8,000 hours supplemented by the required hours of related instruction.

2. RATIO OF APPRENTICES TO JOURNEYWORKERS

The ratio of apprentices to Fire/Life Safety & Electronic Security Technicians shall be one (1) apprentice to one (1) Fire/Life Safety & Electronic Security Technician Journeyworker.

3. APPRENTICE WAGE SCHEDULE

Apprentices shall be paid a progressively increasing schedule of wages based on a percentage of the current journeyworker wage rate.

4 Year Term Example:

1st 6 months + hours = 1000 hours
2nd 6 months + hours = 1000 hours
3rd 6 months + hours = 1000 hours
4th 6 months + hours = 1000 hours

5th 6 months + hours = 1000 hours
6th 6 months + hours = 1000 hours
7th 6 months + hours = 1000 hours
8th 6 months + hours = 1000 hours

4. SCHEDULE OF WORK EXPERIENCE (See attached Occupation Schedule)

The UATC may modify the work processes to meet local needs prior to submitting these Standards to the appropriate Registration Agency for approval.

5. SCHEDULE OF RELATED INSTRUCTION
(See attached Course Outline)

Appendix A

WORK PROCESS SCHEDULE Fire/Life Safety & Electronic Security Installer O*NET-SOC CODE: 47-2111.00 RAIS CODE: 0459

Description: A Fire/Life Safety & Electronic Security Technician is an individual whose primary occupation is the design and/or integration, installation and field maintenance/service of:

- Cabling infrastructure and products that transport low voltage (less than 100 volts) voice, video, audio and data signals in a commercial or residential premises;
- Products that capture and display or otherwise annunciate signals;
- Products that control signals; and
- Products that use signals to control mechanical and electrical apparatus.

On-the-Job-Learning (OJL)

The apprentice will practice the following work processes, demonstrating competency in them over the course of the four (4) years of the program. This constitutes the OJL portion of the apprenticeship. Each general work process is further broken down into specific constituent processes for clarification.

Work Processes	Approx. Hrs
Prepare for System Installation	800
<ul style="list-style-type: none">▪ Review & understand electronic system requirements & documentation (blueprints, etc)▪ Perform site survey▪ Develop overall job plan▪ Organize technical work plan▪ Complete pre-assemblies & fabrication of sub systems▪ Gather inventory /parts▪ Pre-test components▪ Inventory tools	
Wire Buildings	800
<ul style="list-style-type: none">▪ Use documentation to lay out components▪ Secure area – drop cloths-safety cones, etc.▪ Rough in device component locations	

<ul style="list-style-type: none"> ▪ Install cable support structure or drill wire paths ▪ Pull & secure wire ▪ Label tag wire/cable per documentation 	
Trim	1,500
<ul style="list-style-type: none"> ▪ Pre-termination functions <ul style="list-style-type: none"> ○ Prepare cable ends ○ Route cable ▪ Connect passive devices <ul style="list-style-type: none"> ○ Connectors ○ Outlets ○ Patch panels ▪ Splicing ▪ Intermediate termination 	
Install Components	1,500
<ul style="list-style-type: none"> ▪ Remote location components ▪ Central/main location 	
Configure – Program	500
<ul style="list-style-type: none"> ▪ Calibrate & align electronically and physically ▪ Install or enter control programs, if applicable (complex) ▪ Setup system instructions labels, etc (simple) 	
Test, Troubleshooting, Debug	800
<ul style="list-style-type: none"> ▪ Power up ▪ Operate and test functions ▪ Evaluate performance ▪ Identity problems, errors, discrepancies ▪ Diagnose causes of problems ▪ Take remedial action ▪ Document actions (see documentation section) 	
Train Users	500
<ul style="list-style-type: none"> ▪ Review user documentation manuals & instructions ▪ Identify training objectives ▪ Confirm actual users and their requirements ▪ Procure – develop training & user aids manuals tip sheet ▪ Demonstrate system function – guide user through system ▪ Observe user using the system – have customers demonstrate knowledge of the system ▪ Communication results of training back to all relevant parties 	
Documentation	800
Review final blueprints, writing diagrams, and hookup instructions	
<ul style="list-style-type: none"> ▪ Complete work reports and time sheets ▪ Provide/prepare/deliver system documentation 	

- User manual and training materials
- As built drawings
- Zone diagrams
- Equipment lists
- Warranty paperwork

Maintenance & Repair 800

- Maintenance
 - Perform scheduled preventive maintenance
- Repair
 - Diagnose problems

Read documentation

Total Hours 8,000

RELATED INSTRUCTION OUTLINE
Fire/Life Safety & Electronic Security Installer
O*NET-SOC CODE: 47-2111.00
RAIS CODE: 0459

The instructional portion of these Fire/Life Safety & Electronic Security Installer apprenticeship standards is designed to employ the Fire/Life Safety & Electronic Systems Installer program in the “Wheels of Learning” series of publications and materials developed by the Consortium for Fire/Life Safety & Electronic Security Installer Training and the National Center for Construction Education & Research (NCCER). There are four (4) levels of instructional materials, including a trainee guide and an instructor guide for each level.

1st Year	Approx. Hours
Introduction to the Trade Review of the purpose and scope of the electronic systems industry. Explain the technician’s role in the industry. State the rules for professional and ethical conduct. Describes the importance of codes and standards and explains how they affect the work of a Fire/Life Safety & Electronic Security Installer.	10
Basic Safety Provide a comprehensive overview of safety rules and precautions for working on construction job sites.	15
Basic Math Provides refresher practice in additional subtraction, multiplication, and division of whole, decimal, and fractional numbers.	15
Introduction to Hand Tools Explain the selection, inspection, use and maintenance of common hand tools.	10
Introduction to Power Tools Explains the selection, inspection, use and maintenance of common power tools.	5
Introduction to Blueprints Reviews the basic components of blueprints, including title blocks, lines, symbols, and revision symbols.	7.5

Basic Rigging	20
Explains rigging safety, allows for practice. Review types of rigging equipment, inspection procedures. Reviews crane hand signals, types of derricks and cranes. How to tie different types of knots. How to estimate size, weight, and center of gravity.	
Construction Materials & Methods	15
Covers the uses and composition of common types of residential and commercial building materials. Reviews the major structural components of residential and commercial buildings and common methods of construction, including suspended ceilings, cable raceways. Explains how to select the appropriate drills, bits, and cutting tools for making openings in various types of construction materials. Explains how to install plywood on a gypsum board wall.	
Pathways and Spaces	15
Orients apprentice to various types of cable trays, raceways, fittings, and provides strategies for selecting the appropriate size and type for a given application. Reviews methods used to install leveling D-rings and mushrooms, making a conduit-to-box connection, selecting cable support hardware for a given application, and installing an outlet box in drywall.	
Fasteners & Anchors	5
Review the various methods of hand-bending and installing conduit. Reviews the correct applications of fasteners and anchors and how to install them.	
Hand Bending of Conduit	7.5
Review the various methods of hand-bending and installing conduit. Review how to use math formulas to determine conduit bends. Provide practice in making various kinds of conduit bends, and cutting, reaming, and threading of conduit.	
Electrical Theory One	7.5
Cover atomic structure as it related to electricity. Review the definition of voltage and the ways in which it can be produced. Review the difference between conductors and insulators. Define the units of measurement that are used to measure the properties of electricity. Explains how voltage, current, and resistance	

are inter-related. Review Ohm's Law and describes how to calculate an unknown value. Review the different types of meters used to measure voltage, current, and resistance. Describe how to use the power formula and calculate the amount of power used by a circuit.

Electrical Safety

12.5

Review safe working procedures in a construction environment. Explains the purpose of OSHA and how it promotes safety on the job. Reviews electrical hazards and how to avoid or minimize them in the workplace. Explains safety issues concerning lockout/tag out procedures, personal protection using assured grounding and isolation programs, confined space entry, respiratory protection, and fall protection systems.

Low-Voltage Cabling

20

Explains the various sizes and gauges of wire in accordance with the American Wire Gauge (AWG) standards and describes how to determine the proper gauge for an application. Reviews how to read and identify markings on conductors and cables. Describes the different materials from which conductors are made. Describes the different types of conductor insulation. Describes the color-coding of insulation. Reviews procedures to plan and set up for a cable pull. Explains how to properly install a pull line for a cable pulling operation. Explains how to prepare the ends of conductors for pulling and safety pull cable through conduit in vertical and horizontal pathways. Reviews how to wrap, tie, fasten, label, and protect cable, and explains the importance of maintaining the proper slack. Describes the installation of cables in cable trays. Review the restrictions imposed by the NEC on the uses of various types of cable.

1st Year Hours Total:

165

2nd year	Approx. Hours
Craft-Related Mathematics This instruction expands on the knowledge gained in the Basic Math module. Emphasis is placed on the metric system, including how to convert between corresponding English and Metric System Units. Also covered is the use of scientific notation, powers and roots, and the basic concepts of algebra, geometry, and right-angle trigonometry.	7.5
Electrical Theory II Introduce series, parallel, and series-parallel DC circuits. Cover Kirchoff's Voltage and Current Laws, and circuit analysis. Also provides an introduction AC theory, components and circuits.	12.5
Basic Electronics Covers the principles of electronics and provides an introduction to semiconductor theory, components, and applications.	10
Electrical Test Equipment Covers selection, inspection, use, and maintenance of common electrical test equipment, including meters, oscilloscopes, meggers, wattmeter's, frequency meters, time domain reflectometers, continuity testers, recording instruments, and RF analyzers.	15
Power Quality and Grounding Cover the purpose for grounding and bonding of electrical systems. NEC regulations pertaining to grounding and bonding are thoroughly covered. Equipment and devices used for grounding and bonding are covered including their methods of installation. Also introduced in this module is an explanation of power quality, along with the causes and effects of poor power quality. Equipment and devices used to maintain good power quality are covered.	20
Introduction to Electrical Blueprints Cover electrical prints, drawings, and symbols. Apprentices learn the types of information they can find on schematics, one-line drawings, and wiring diagrams.	7.5

Voice and Data Systems 25

Presents background information for the installation and termination of telephone and data systems. Emphasis is placed on the different schemes used for premises wiring of these systems. Cables, cabling termination devices, installation guidelines, and troubleshooting methods used with voice and data system cabling are also introduced.

Switching Devices and Timers 10

Presents the principles of operation and describes the different types and configurations of switches, relays, timers, and photoelectric devices. Guidelines for the selection of appropriate devices using specification sheets are also covered.

Terminating Conductors 15

Provides information and detailed instructions for selecting, installing, and testing connectors and other terminating devices on various cables used in low-voltage work, including telecommunications, video and audio, and fiber optic.

Introduction to Codes and Standards 10

This module describes the scope and content of the major codes and standards that apply to the telecommunications, life safety, security, and other low-voltage systems. Emphasis is placed on the familiarization and use of the National Electrical Code® (NEC®).

Computer Applications 20

Reviews common terms related to computers and computer networks. Reviews the components of a personal computer and explains the function of each. Review the procedures for uploading and downloading files to security, lighting control, or fire systems. Explains how to build and test a null modem cable. Describes how to set up and configure a personal computer. Step trainee through procedure for loading of application software on a computer and on to using the computer to perform a task.

Explain the function of each level of the open systems interconnection (OSI) reference model for data communication. Describes the characteristics of and uses for various types of data transmission media. Describe the function of the internet as it relates to network protocols.

2nd Year Hours Total

152.5

3rd Year

Approx. Hours

Cable Selection

15

Cover the selection of cables for specific application. Explain how to calculate voltage drop for various applications. Explain how to interpret and apply NEC regulations governing conductors and cables. Explain how to size cable conductors for a given load. Practice in applying various formulas and charts for load calculations.

Busses and Networks

25

Explain the function of each level of the open systems interconnection (OSI) reference model for data communication. Describes the characteristics of and uses for various types of data transmission media. Explains how communication devices are connected to a transmission medium. Explain the methods of providing access control. Explains the operating principles of network topologies and how information is transferred using them. Describe the functional interrelationship between the OSI model layers and the network protocol. Describe the function of the internet as it relates to network protocols. Explain the composition of microcomputer-based local area networks (LANs). Describe the various proprietary control networks. Describe the functions of bridges, routers, and gateways. Reviews the protocols used with wide area networks (WANs).

Fiber Optics

20

Explains the basic principles of fiber optic technology, including: fundamentals, benefits, and applications of fiber optic system; operational considerations of fiber optic system; construction of an optical fiber; and various types of fiber optic cable. Review the

design, operation, and performance of a fiber optic transmitter and receiver. Review the types and construction of fiber optic detectors. Explain the desirable features and connector losses of a fiber optic connector or splice. Explains and demonstrates the installation of fiber optic cabling and support equipment, the applications and types of fiber optic splicing/termination, and testing procedures for fiber optic systems.

Maintenance and Repair

15

Explain the difference between maintenance and repair. Describe the general approach to troubleshooting a problem. Review the common causes of system and equipment failures, Reviews procedures for isolating common problems in a system or software and common faults in wiring and equipment. Reviews common preventive maintenance measures and the method used to determine the frequency and extent of preventive maintenance.

Wireless Communication

15

Describe the fundamental principles of wireless RF communication and wireless personal communication. Review the basic components used in wireless systems and explains the function of each. Explain the basic operating principles of infrared systems and reviews the various types of devices used in those systems. Explain the operating principles and applications of power line carrier (PLC) systems, wireless computer networks, and satellite communication systems. Reviews the test equipment used in testing and troubleshooting wireless communications systems and the purpose of each piece of equipment. Covers the procedure for installing and testing an RF or IR wireless communication system and antennas.

Video Systems

15

Describes the basic components of a cable television system, including coaxial cable. Reviews the advantages and disadvantages of a flat transmission line. Reviews the requirements for impedance matching of cables, including standing wave ratio and signal-to-noise ratio. Explain the power and signal loss calculations for coax cable distribution systems. Describe the

operation of equipment for signal analysis and level measurement. Describes the operation of satellite television systems, broadcast television antenna systems, closed-circuit television (CCTV) systems, master antenna and satellite master antenna television systems, and system grounding for interference suppression.

Audio Systems

20

Describe audio system components including sources, amplification equipment, signal processing devices and reproduction devices. Describe fundamental technical audio issues such as room acoustics, background noise, free space attenuation and echoes. Explain power requirements, cabling options, system configurations and basic design considerations. Cover standard procedures for system installation from a building code perspective and best practices for system testing and troubleshooting. Review the common test equipment used during installation and troubleshooting.

Media Management Systems

10

Explains the basic principles behind shared media resources and access to them via a computer network or hardware application. Describes media types used for origination sources both on an analog and digital platform including optical storage devices. Explain cabling options including fiber optic interfaces, broadband and base band systems and twisted pair topologies. Describes user interfaces and software commonly used for this application. Review installation practices, common testing and troubleshooting procedures and user training techniques.

Rack Assembly

15

Describe best practices for assembling electronic system enclosures including power sequencing, grounding, weight distribution and heat dissipation. Explains cable routing based on signal levels being transmitted within the rack. Describe structural requirements and seismic considerations for various environments and applications. Explain electrical power distribution and load calculation for equipment being housed within the rack. Cover electrical inspector's expectations for power and connection to the building grounding system.

User Training & System Commissioning 15

Describe the industry's best practices for project close-out and end user required training.

Explain documentation and owners manuals that are required. Describe levels of training required based on owners personnel ranging from system operators to facility managers. Cover the basics in final testing and close-out procedures on typical systems and how to build this in as part of the overall project. Describes customer satisfaction levels and expectations on what materials need to be turned over during the cut-over phase of the project.

3rd Year Hours Total 165

4th Year Approx Hours

Site Survey, Project Planning Documentation 15

Describes the general procedure and steps involved when estimating a job for the purpose of submitting a bid, and the steps required to properly plan and complete a job once a contract for the job has been awarded. Review how to interpret contractual documents, working drawings, and specifications pertaining to a job to determine the requirements and scope of the work. Explain how to perform a site survey in order to establish or confirm the installed locations of new and/or existing equipment and the routing of the related cabling. Reviews how to develop a schedule for accomplishing a job or task from start to finish that efficiently accomplishes the work and is also compatible with the work performed by other trades. Describe the general procedures for accomplishing a job, including those that apply to assuring compliance with codes and standards and the control of materials, tools, and equipment.

Introduction to Supervision 15

Describe the role of the supervisor in the construction industry. Defines an organization chart and explains why it is important to know where you fit in. Describe the personal qualities and various traits of an effective leader/supervisor. Explain how to communicate effectively. Describes motivational techniques and how they are used to get others to perform. Explains the various elements of leadership and how these are used by the supervisor on the job site. Describe the systematic problem-solving technique when dealing

with personal problems. Reviews some of the major construction documents, describes their purposes, and explains how certain documents affect the role of the supervisor. Describes how a job is closed out and how to staff a job. Explain how to develop a training program and orient a new employee to the company and job. Review scheduling and several types of project schedules. Describe the role the supervisor plays in job site safety.

Fire Alarm Systems

40

Review the components of a fire alarm system. Explain how to calculate battery standby and total system load. Describe how to calculate voltage drop of a notification appliance circuit (NAC). Explain the difference between photo/ion/hear, multi, and uv/iv sensors. Demonstrate how to draw a 2-wire/4-wire initiating device circuit (IDC). Explain how to install and troubleshoot a 4-wire initiating device circuit. Cover how to use the National Fire Alarm Code to lay out the proper smoke detector location for a door-holder application. Covers how to use the NFA Code to determine the locations and number of detectors required in a newly-constructed residential dwelling.

Security Systems

30

Reviews the types of services security systems provide, including burglar alarm (BA), Hold-up alarm (HUA), Access control, CCTV, and local vs. monitored services. Reviews the various types of sensors, their applications and connection methods-including hardwire (zone), multiplex (point), and wireless (point). Review the standard types of indicating devices (bells, sirens). Describe the various types of control panels. Explain the various types of wiring methods. Describe primary and standby power requirements. Review basic system design concerns, including detector location, UL requirements, and false alarm prevention. Reviews system programming options (enter/exit delays). Cover procedures for testing and maintenance of security systems.

Nurse Call & Signaling Systems

15

Covers basic emergency call and duress system requirements based on facility type. Explain the different system configurations and wiring schemes based on system type. Describe the installation

procedures based on facility types and the U.L. and other building code specifications that dictate the use of these systems. Explain the connectivity options to auxiliary devices such as remote signaling systems, PBX and pages, electronic beds and other systems. Describe the requirements for proper grounding and static discharge tolerance on the components. Cover system troubleshooting and testing procedures along with code compliance.

CCTV Systems

15

Describe the basics for installation and configurations of closed circuit TV equipment. Explain system components such as cameras, remote-positioning devices, sequential switches and monitors. Explain building code and laws governing the use of these systems and the basics on integration to graphic user interfaces. Cover the test equipment and procedures for testing and troubleshooting. Explain cabling options and the interfaces used for media conversion.

Broadband (MATV) Systems

15

Describe the major elements of head-end design and installation including antenna or satellite options, receivers and modulators, and amplification and distribution devices. Explain coaxial and optical fiber distribution methods and the function of all devices used to distribute signals for an internal or external system. Cover proper signal levels, cable attenuation, insertion loss and acceptable carrier-to-noise levels. Explain the common test equipment and troubleshooting procedures.

Systems Integration

20

Present the big picture concepts for connecting two or more stand-alone systems together that will improve the capabilities of each system. Describe the best practices for interoperability and system performance. Explain the various interconnection options and protocols commonly used for integration. Cover network configurations

used, wiring schemes and fault-tolerant procedures designed for system redundancy. Cover graphic user interfaces and custom application-driven solutions commonly used in today's high tech building automation systems.

4th Year Hours Total

165